Appl. No.	:	10/561,032 (based on PCT/US2004/021265)
Applicant	:	Gerald P. Fox
Filed	:	December 16, 2005
Title	:	TRANSMISSION CONTAINING HELICAL GEARING AND BEARING ARRANGEMENT THEREFOR
TC/A.U.	:	3681
Examiner	:	Roger L. Pang
Docket No.	:	TIMK 8718W1

Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR 1.132

Sir:

I, Gerald P. Fox, declare as follows:

1. I reside in Massillon, Ohio, and am employed in nearby North Canton, Ohio, by the Timken Company as a Chief Technologist – Mechanical Technology. The Timken Company manufactures a wide variety of antifriction bearings.

2. I hold a bachelors degree in mechanical technology engineering from the University of Akron, it having been awarded in 1971. I joined The Timken Company in 1967, and since then have worked in various capacities including Chief Engineer – Industrial Customer Engineering, Chief Engineer – Advanced Application Development, Chief Engineer – Wind Energy, and Chief Technologist – Mechanical Technology.

3. In 1999, I began to work with transmissions for wind turbines that generate electrical power. The typical wind turbine includes a rotor that carries blades against which the wind impinges, an electrical generator, and a transmission

interposed between the rotor and generator. The rotor turns at a relatively low angular velocity, whereas the generator operates at a substantially higher angular velocity. The transmission is designed to increase the angular velocity from the input to the output and is referred to as a speed increaser. Experience has shown speed increasers to be highly problematic, and consequently, their design has been the cause of much consideration in the wind turbine design community as well as in wind turbine standards organizations, such as the American Gear Manufacturers Association (AGMA). In connection with my work on transmissions for wind turbines, I joined the AGMA committee that establishes the AGMA 6006 gear box standard for wind turbines. On this committee, I served as a representative for The Timken Company, and in a broader sense as a member from the bearing community, there to assist the committee on matters related to bearing requirements. I have also attended conferences in Europe and the U.S. on the subject of wind turbines for generating electrical power.

4. My work in connection with transmissions for wind turbines produced several inventions for which the U.S. Patent Office granted patents to the Timken Company, namely:

Patent No.	**Title**
7,297,086	Epicyclic Gear Systems
7,056,259	Epicyclic Gear System

6,994,651	Epicyclic Gear System
6,770,007	Epicyclic Drive With Unified Planet Assemblies

The work also produced other inventions that now form the subject published international applications, namely:

Publication No.	**Title**
WO2005/110032	Locating Bearing Assembly for Wind Turbine Gearbox
WO2007/016336	Epicyclic Gear System With Flexpins

5. I have reviewed the patent application that forms the subject of this declaration and the official action of January 29, 2008, including the examiner's comments on the patentability of the transmission. I have also reviewed the examiner's comments on patentability in the International Preliminary Examination Report mailed 16 January 2007 and note that it differs from the opinion rendered by an examiner in the European Patent Office in connection an earlier International Preliminary Examination Report issued by the European Patent Office. I understand that the examiner who has considered this application contends that in 2003 it would have been obvious to one skilled in designing transmissions for wind turbines to construct the transmission set forth in the application from a consideration of Japanese published application 10/096,463 and the Timken website; particularly the segment of the website that is devoted to Timken's TSU

bearing, which is a unitized single row tapered roller bearing capable of supporting axial loads in both directions as well as radial loads. I disagree.

6. Wind turbine transmissions typically have intermediate and output shafts that are coupled through gears on the two shafts. Moreover, the intermediate shaft carries another gear that is engaged by a bull gear. All the gears are helical, and thus impart thrust loads to the shafts to which they are fitted. The bearings that support the shafts must support the thrust loads. Several bearing arrangements exist for accommodating the thrust loading on a shaft that carries helical gears in a wind turbine transmission. One utilizes a double row spherical roller bearing at one end of the shaft and a single row bearing of some type at the other end as in the Japanese application that has been cited. Another substitutes a double row tapered roller bearing for the double row spherical roller bearing. Still another utilizes a cylindrical roller bearing and a deep groove ball bearing at one end of the shaft and a cylindrical roller bearing at the other end as depicted in Fig. 1 of this application. Still another utilizes two single row tapered roller bearings mounted in opposition at opposite ends of the shaft, this arrangement being known as cross-located tapered roller bearings.

7. In the transmission of this patent application, a single row tapered roller bearing, unitized so as to be capable of supporting thrust loads in both axial directions, replaces the conventional bearing arrangements to which I have

referred. Those arrangements consume considerable space or can be sensitive to the effects of differential thermal expansion. Moreover, the single row unitized bearing of my transmission is oriented such that the thrust load of greatest magnitude transfers radially through the rollers along the tapered raceways of its cup and cone, this being when the wind turbine is generating electrical power. When the thrust is in the opposite direction, which is when the generator of the turbine operates as a motor, the thrust load transfers longitudinally through the rollers to the ribs connected to the cup and cone.

8. The world's leading experts on the design of transmissions for wind turbines attend the AGMA committee meetings for wind turbine gearbox design. I have attended many of those meetings as well, and never have I heard the experts mention or recognize that a single row unitized tapered roller bearing could be substituted for any of the conventional bearing arrangements in wind turbine transmissions. They have always fixated on two row tapered roller bearings, two row spherical roller bearings, combination ball and cylindrical roller bearings, or cross-located single row tapered roller bearings as the means for supporting shafts for rotation while accommodating the thrust induced by the helical gearing. The same held true when I conferred with the actual designers and manufacturers of wind turbine transmissions – and I have conferred to varying degrees with most of them. The experts, the designers, and the manufacturers are all wedded to one of

the conventional bearing arrangements for supporting the shafts in wind turbine transmissions, and never considered the advantages of a single row unitized tapered roller bearing as set forth in this patent application.

9. I believe that I have at least ordinary skill in designing transmissions for wind turbine generating units. In my opinion, one of ordinary skill would probably not turn for inspiration to the Timken website where it shows along with many other styles of bearings, the single row unitized tapered roller bearing, there designated as the "TSU (UNIT-BEARING)." This style of bearing was primarily designed in four small sizes (stated on the website with bore sizes ranging between 30 and 45mm) for automotive wheel ends, but in some cases can be applied to small industrial gear reduction units. But even if a wind turbine transmission designer of ordinary skill were to consult the Timken website for inspiration, the description of this product on the Timken website (very small sizes for automotive applications) would logically dismiss most, if not all, from consideration for application to a massive wind turbine gear box. It is highly unlikely that one of ordinary skill would recognize it as a logical substitute for the more customary bearing arrangements that such a person normally applies. In reality, the small TSU bearing shown on the Timken website would not even work properly in a wind turbine transmission.

10. All statements made herein of my own knowledge are true and all statement made on information and belief are believed to be true. These statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Gerald P. Fox

Gerald P. Fox

North Canton, Ohio
February __, 2008